(EEAP) LIGHTING SURVEY STUDY

AT THE

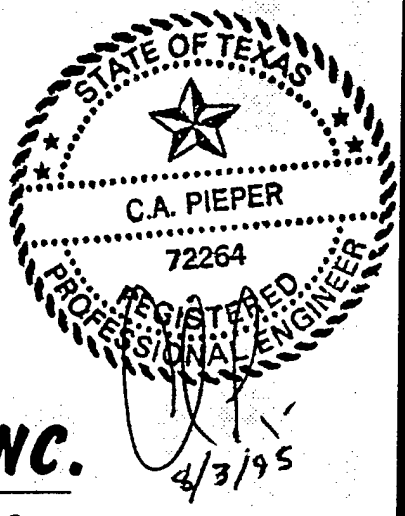
FORT BLISS

EL PASO, TEXAS

VOLUME I

FINAL REPORT

US Army Corps
of Engineers
Fort Worth Division



CONDUCTED BY

HUITT-ZOLLARS, INC.

CONSULTING ENGINEERS
FORT WORTH, TEXAS

8/3/95

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(EEAP) Lighting Survey Study
at
Fort Bliss
El Paso, Texas

FINAL REPORT
August 3, 1995

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I. EXECUTIVE SUMMARY

A. Introduction

This energy conservation study was performed by Huitt-Zollars Inc, for the U.S. Army Engineer District (USAED), Fort Worth, under contract number DACAC63-94-D-0015. The study was conducted at Fort Bliss in El Paso, Texas, between October 31, 1994 and May 12, 1995. The site survey and data collection was performed by C.A. Pieper, P.E., Tom Luckett, Lighting Designer, and Merrel Nichols, CADD Technician.

The purpose of the study was to perform a limited site survey of specific buildings at the facility, identify specific Energy Conservation Opportunities (ECOs) that exist, and then evaluate these ECOs for technical and economic feasibility. These ECOs were limited to building interior lighting and it's effects on the heating, ventilating and air conditioning (HVAC) systems.

This survey was conducted with the assistance of many persons at the facility. Special thanks are extended to all of them, including the following individuals:

Mr. Joe Mathis, Energy Coordinator
Mr. Raymond Balderos, Utilities Sales Clerk
Mr. Louis Arenas, Electrical Maintenance Supervisor

Any questions concerning this report should be directed to the Project Manager, C.A. Pieper, P.E., at Huitt-Zollars Inc., 512 Main Street, Suite 1500, Fort Worth, Texas 76102. Phone 817-335-3000.

B. Buildings Studied

This study was conducted on a total of 132 buildings at Fort Bliss. Of this total number of buildings, there were 52 unique building types. All of the other buildings were duplicates of one of these unique buildings. A complete description of all buildings studied is provided on page 9. The total building area covered in this study was 1,818,828 sqft.

C. Present Energy Consumption

Base Year Energy Consumption: The total metered electrical and gas consumptions for 12 consecutive months, prior to this study, were obtained from the facility and are referred to as the 'base year'. These data are shown on page 12 and are summarized as follows:

Electrical	157.0 MWH
Gas	936,041 MCF

Lighting Energy Consumption: The present annual lighting energy consumption (HVAC not included) for the building areas studied was calculated on page B-3 as follows:

Lighting Energy	4,990,613 KWH
	3.1% of base year total

D. Energy Conservation Opportunity (ECO) Analysis

ECOs Rejected: After reviewing the data collected at the facility and considering all of the practical limitations involved, certain potential ECOs were rejected prior to performing calculations. These ECOs are summarized below with their reasons for rejection.

1. *Remove Lamps or Fixtures:* This ECO was rejected because all areas which were found that had excessive amounts of lighting were included in other ECOs which recommended replacement of the existing lighting with more efficient fixtures. The light levels for all overlighted areas were reduced in these calculations. See Appendix C.

2. *Install Additional Switches in Large Areas, Turn Lights Off:* Most of the building areas were found to be evenly occupied during working hours, and the addition of extra switches for groups of lights in a large area would not allow lights to be turned off. Those areas that had irregular or intermittent occupancy were considered for adding occupancy sensors to turn off lights. See item 7 below.

3. *Install Fluorescent Reflectors in Existing Fixtures:* This ECO requires installing the polished silver reflectors into 4 lamp fluorescent fixtures and then removing 2 lamps and a ballast. While this cuts the fixtures energy consumption in half, it also drops the lumen output from the fixture by at least 1/3, based on IES tests. Therefore, an area must be overlighted by at least 33% in order to maintain acceptable light levels. Very few areas were found that could meet this criteria.

4. *Replace Exit Signs With Low Wattage Signs:* There are many different types of exist signs at Fort Bliss, and many are not illuminated. Because there appears to be no stringent requirement for illuminated exit signs at the facility, any uniform replacement of the existing signs with low wattage illuminated signs would likely increase the lighting energy consumption. However, all new exit sign installations should be standardized to use only low wattage LED or fluorescent types, rather than the incandescent type.

5. *Install Compact Fluorescent Lamps in Incandescent Fixtures:* These new compact fluorescent lamps, which screw into existing lamp sockets, can easily be replaced with inefficient incandescent lamps. Also, they are limited in their application due to their large physical size. Finally, incandescent fixtures are designed for incandescent lamps, which have a very different light emission pattern than compact fluorescent lamps. Without the proper reflective surfaces in the fixtures, much of the new fluorescent light is trapped inside the fixture. This results in lower than expected lighting output from the existing fixtures. These lower light levels are often determined to be unacceptable by the occupants and the new fluorescent lamps are soon replaced with incandescent lamps. Since experience with this type of energy conservation retrofit has shown that the benefits cannot be guaranteed, this potential ECO has been rejected.

6. *Install Occupancy Sensors To Turn Off Lights:* Certain areas of the buildings were considered for installing occupancy sensors to turn off lights during unoccupied periods. However, these areas all had inefficient lighting which should be upgraded (see ECO-1 and 2). After upgrading the lighting in these areas, the potential amount of energy saved by installation of sensors is substantially reduced. Because of the reduction in potential energy and cost savings, this ECO was rejected. However, should the lighting not be upgraded as recommended, these sensors should be considered. Application data for occupancy sensors has been included in Appendix F.

ECOs Recommended: Certain ECOs which were identified during the building survey have been evaluated for technical and economic feasibility and are recommended for implementation. Complete documentation of all calculations as well as information required for implementation is included in Appendix C. These recommended ECOs are summarized below in order of descending Savings to Investment Ratio (SIR).

ECO 1: Replace Existing Incandescent And Mercury Vapor Lighting.

Electrical Energy Savings	913,758	KWH/yr
Electrical Demand Savings	6,412	KW-mo/yr
Natural Gas Energy Penalty	537.5	MMBTU/yr
Net Energy Savings	2,581	MMBTU/yr
Annual Cost Savings	274,583	$/yr
Total Investment	640,824	$
Simple Payback	2.3	yrs
SIR	6.38	

ECO 2: Replace Existing Fluorescent Lighting With Electronic Fluorescent Lighting

Electrical Energy Savings	1,614,040	KWH/yr
Electrical Demand Savings	9,191	KW-mo/yr
Natural Gas Energy Penalty	949.3	MMBTU/yr
Net Energy Savings	4,559	MMBTU/yr
Annual Cost Savings	231,039	$/yr
Total Investment	1,536,567	$
Simple Payback	6.6	yrs
SIR	2.24	

ECOs Not Recommended: All ECOs which were considered applicable at this facility, and were not rejected for reasons mentioned above, were recommended for implementation. Therefore, there are no ECOs which were calculated and were not recommended.

ECIP Projects Developed. The facility decided not to submit any projects for ECIP funding. All projects will be submitted for funding as Non-ECIP projects.

Non-ECIP Projects Developed. The energy coordinator decided to combine the two recommended ECOs together for implementation and create six projects by dividing the buildings studied into six groups. The following projects which resulted from this procedure will be submitted for funding as Non-ECIP projects. They are summarized below in order of descending Savings to Investment Ratio (SIR).

Project 5. Lighting Systems Upgrade

Buildings: 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357

Electrical Energy Savings	256,665	KWH/yr
Gas Energy Penalty	151	MCF/yr
Total Energy Savings	725	MMBTU/yr
Total Cost Savings	79,987	$/yr
Total Investment	228,724	$
Simple Payback	2.8	yrs
SIR	5.20	

Project 6. Lighting Systems Upgrade

Buildings: 2527, 2528, 2529, 2536, 2537, 2538, 2588, 5000, 5804, 5805, 5808, 5838, 5843, 5849, 5850, 5851, 5852, 5853, 5854, 5855, 5856, 5857, 5858, 5859, 5860, 5863, 5864

Electrical Energy Savings	748,315	KWH/yr
Gas Energy Penalty	440	MCF/yr
Total Energy Savings	2,114	MMBTU/yr
Total Cost Savings	126,135	$/yr
Total Investment	501,141	$
Simple Payback	3.9	yrs
SIR	3.74	

Project 4. Lighting Systems Upgrade

Buildings: 1101, 1102, 1103, 1104, 1105, 1106, 1111, 1112, 1113, 1114, 1115, 1116, 1117, 1118, 1119, 1120, 1122, 1123, 1124, 1178, 1179, 1180, 1181, 1270, 1271, 1272, 1273, 1274, 1275, 1276, 1277, 1278, 1279

Electrical Energy Savings	197,773	KWH/yr
Gas Energy Penalty	117	MCF/yr
Total Energy Savings	558	MMBTU/yr
Total Cost Savings	49,317	$/yr
Total Investment	221,949	$
Simple Payback	4.5	yrs
SIR	3.31	

Project 1. Lighting Systems Upgrade

Buildings: 1, 8, 11, 12, 13, 51, 54, 55, 56, 58, 111, 112, 113, 114, 115, 116, 117, 118, 311

Electrical Energy Savings	424,260	KWH/yr
Gas Energy Penalty	250	MCF/yr
Total Energy Savings	1,198	MMBTU/yr
Total Cost Savings	79,027	$/yr
Total Investment	372,139	$
Simple Payback	4.7	yrs
SIR	3.16	

Project 2. Lighting Systems Upgrade

Buildings: 500, 503, 504, 512, 515, 516

Electrical Energy Savings	529,739	KWH/yr
Gas Energy Penalty	312	MCF/yr
Total Energy Savings	1,496	MMBTU/yr
Total Cost Savings	86,872	$/yr
Total Investment	465,988	$
Simple Payback	5.3	yrs
SIR	2.77	

Project 3. Lighting Systems Upgrade

Buildings: 720, 721, 722, 723, 724, 725, 738, 739, 740, 745, 746, 747, 754, 755, 756, 762, 769

Electrical Energy Savings	370,934	KWH/yr
Gas Energy Penalty	218	MCF/yr
Total Energy Savings	1,048	MMBTU/yr
Total Cost Savings	61,184	$/yr
Total Investment	387,474	$
Simple Payback	6.3	yrs
SIR	2.35	

Recommended Maintenance & Operations Practices: The following maintenance and operations (M&O) practices are recommended to help conserve lighting energy at Fort Bliss.

1. The Energy Coordinator should work together with the Fort Bliss Director of Public Works to develop a Standard Specification for all future lighting repair and renovation projects. All facility lighting designers, as well as 'You Do It' designers, should be required to follow this specification. The energy coordinator should review all new lighting designs to check for compliance with the specifications. This will help to eliminate the inadvertent use of inefficient lighting systems at the facility.

2. Facility lighting designers should obtain and use published design lighting levels for all lighting renovation projects or new installations. This will help to eliminate overlighting.

3. The installation of new incandescent lighting should be prohibited. More efficient sources should be used in all cases.

4. The energy coordinator should attend training seminars for building energy managers, such as those listed in Appendix F.

5. The energy coordinator should direct considerable energy conservation efforts towards the production processes using electrical energy, as this is the largest area of potential savings. See page 12, *Utility Data*, for more details.

E. Energy And Cost Savings

Total Potential Energy and Cost Savings. The calculated energy and cost savings from the implementation of all the Non-ECIP projects is as follows:

Electrical Energy Savings	2,527,686	KWH/yr
Gas Energy Penalty	1,488	MCF/yr
Total Energy Savings	7,139	MMBTU/yr
Total Cost Savings	482,522	$/yr
Total Investment	2,177,415	$
Simple Payback	4.5	yrs

Energy Use and Costs Before and After. Based on the 'base year' electrical and gas energy consumptions and costs shown on page 12, and the calculated total potential savings above, the Fort Bliss energy and usage and costs before and after implementation of the Non-ECIP projects is as follows:

	Before	After
Electrical	157.0 MWH	154.4 MWH
Gas	936,041 MCF	937,529 MCF
Total Cost	11,663,837 $	11,181,315 $

Percentage Saved. Based on the base year electrical and gas energy consumptions and costs, the percentage of savings from all the Non-ECIP projects is as follows:

$$\textit{Electrical Energy Saved} = \left[\frac{2.5\ MWH}{157.0\ MWH}\right] = 1.6\%$$

$$\textit{Gas Energy Penalty} = \left[\frac{1{,}488\ MCF}{936{,}041\ MCF}\right] = 0.1\%$$

$$\textit{Energy Cost Savings} = \left[\frac{482{,}522\ \$}{11{,}663{,}837\ \$}\right] = 4.1\%$$